

CLAIMS

1. A hydrogen permeable membrane for selectively allowing hydrogen to permeate therethrough, comprising:

a metal base layer containing vanadium (V);

a metal coating layer containing palladium (Pd); and

an intermediate layer that is formed between the metal base layer and the metal coating layer and is made of a metal having a higher melting point than the metal base layer and the metal coating layer and possessing hydrogen permeability.

2. The hydrogen permeable membrane according to claim 1, wherein the metal constituting the intermediate layer is composed of a single metal element.

3. The hydrogen permeable membrane according to claim 2, wherein the metal element is tantalum (Ta) or niobium (Nb).

4. The hydrogen permeable membrane according to claim 1, wherein the metal constituting the intermediate layer is an alloy.

5. The hydrogen permeable membrane according to claim 4, wherein the intermediate layer is made of an alloy that is composed of a base metal having a higher melting point than the metal base layer and the metal coating layer and an additive metal.

6. The hydrogen permeable membrane according to claim 5, wherein the base metal is metal of group V.

7. The hydrogen permeable membrane according to claim 5 or 6, wherein the additive metal is vanadium (V) or palladium (Pd).

8. The hydrogen permeable membrane according to claim 5 or 6, wherein the intermediate layer comprises a first intermediate layer that is in contact with the metal base layer and a second intermediate layer that is in contact with the metal coating layer, wherein the first intermediate layer comprises vanadium (V) as the additive metal, and wherein the second intermediate layer comprises palladium (Pd) as the additive metal.

9. The hydrogen permeable membrane according to claim 5 or 6, wherein the additive metal contains at least one metal selected from cobalt (Co), nickel (Ni), copper (Cu), molybdenum (Mo), and titanium (Ti).

10. The hydrogen permeable membrane according to claim 5 or 6, wherein the additive metal contains at least one metal selected from silver (Ag), gadolinium (Gd), yttrium (Y), and platinum (Pt).

11. The hydrogen permeable membrane according to claim 5 or 6, wherein the intermediate layer comprises a first intermediate layer that is in contact with the metal base layer and a second intermediate layer that is in contact with the metal coating layer, wherein the first intermediate layer comprises, as the additive metal, at least one metal selected from cobalt (Co), nickel (Ni), copper (Cu), manganese (Mn), and titanium (Ti), and wherein the second intermediate layer comprises, as the additive metal, at least one metal selected from silver (Ag), gadolinium (Gd), yttrium (Y), and platinum (Pt).

12. A fuel cell comprising:

an electrolyte membrane comprising an electrolyte layer possessing proton conductivity and a hydrogen permeable membrane formed on one face of the electrolyte layer;

an oxidative gas supply portion that supplies an oxidative gas containing oxygen to one face of the electrolyte membrane; and

a fuel gas supply portion that supplies a fuel gas containing hydrogen to the other face

of the electrolyte membrane,

wherein the hydrogen permeable membrane is the hydrogen permeable membrane according to any one of claims 1 to 11.

13. A hydrogen extracting apparatus for extracting hydrogen from a hydrogen-containing gas containing hydrogen, comprising:

the hydrogen permeable membrane according to any one of claims 1 to 11;

a hydrogen-containing gas flow passage which is formed on a first face of the hydrogen permeable membrane and through which the hydrogen-containing gas passes; and

an extracted hydrogen flow passage which is formed on a second face of the hydrogen permeable membrane and through which hydrogen that has permeated through the hydrogen permeable membrane and been extracted from the hydrogen-containing gas passes.

14. A method of manufacturing a hydrogen permeable membrane for selectively allowing hydrogen to permeate therethrough, comprising:

preparing a metal base layer containing vanadium (V);

forming an intermediate layer made of an alloy on the metal base layer; and

forming a metal coating layer containing palladium (Pd) on the intermediate layer,

wherein the alloy has a higher melting point than the metal base layer and the metal coating layer and possesses hydrogen permeability.